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Medical Waste Incinerator Waste Management Plan Malcolm Grow Medical Center, Building 1056, Andrews Air Force Base, Maryland

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State of Maryland's regulations require that any person who owns or operates a hospital, medical and infectious waste incinerator prepare a waste management plan that identifies the feasibility and approach to solid waste segregation or material substitution to reduce the amount of toxic emissions. This waste management plan has been written to meet these requirements for the Malcolm Grow Medical Center at Andrews AFB, MD.

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INTRODUCTION

Medical waste is generally defined as any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biological materials and/or chemicals. At Andrews AFB, approximately 69 tons of medical waste was generated by Malcolm Grow Medical Center in calendar year 2000, 91 percent of which was incinerated on-site.

The U.S. Environmental Protection Agency (EPA) and the State of Maryland have promulgated regulations limiting emissions from medical waste incinerators. Maryland's regulations are listed under Title 26, Subtitle 11,Chapter 08 of the Annotated Code of Maryland. Section 26.11.08.08-1A (3) and 40 CFR Part 60.55c, Subpart Ec, require that any person who owns or operates a hospital, medical and infectious waste incinerator (HMIWI) prepare a waste management plan that identifies the feasibility and approach to solid waste segregation or material substitution to reduce the amount of toxic emissions. This waste management plan has been written to meet these requirements. Per 40 CFR 60.55c, the American Hospital Association's (AHA) publication entitled *An Ounce of Prevention: Waste Reduction Strategies for Health Care Facilities* has been considered in the development of this plan.

The Malcolm Grow Medical Center has been extremely proactive in controlling emissions from its medical waste incinerator. The Joy Energy System, Model 480-E, incinerator is equipped with a high energy Venturi caustic/water scrubber that minimizes emissions of criteria and toxic pollutants. The Medical Center has reduced the amount of waste burned over the past 7 years from 140 tons per year (tpy) to 69 tpy; a reduction of greater than 50 percent. Toxic emissions from incineration of medical waste have been reduced proportionally. The reduction in waste generated and burned surpasses the goal agreed to between the EPA and AHA, which requires that the total volume of medical waste generated be reduced by 50 percent by the year 2010.

This waste management plan will discuss the sources of medical waste at Malcolm Grow Medical Center, practices implemented and planned to reduce the amount of waste generated and the amount of toxic components, and recent performance (stack) test results.

CURRENT PRACTICES AND PERFORMANCE

In accordance with State operating permit requirements, the Malcolm Grow Medical Center has kept records of the amount of medical waste incinerated or shipped off-site since 1994. As mentioned in the Introduction, the amount of waste generated at Malcolm Grow has dropped over 50 percent from over 140 tpy in 1994 to 69 tpy in 2000. Figure 1 shows this trend. A review of emissions data developed during testing of the HMIWI in November 2000 indicates that the principle toxic pollutants emitted by

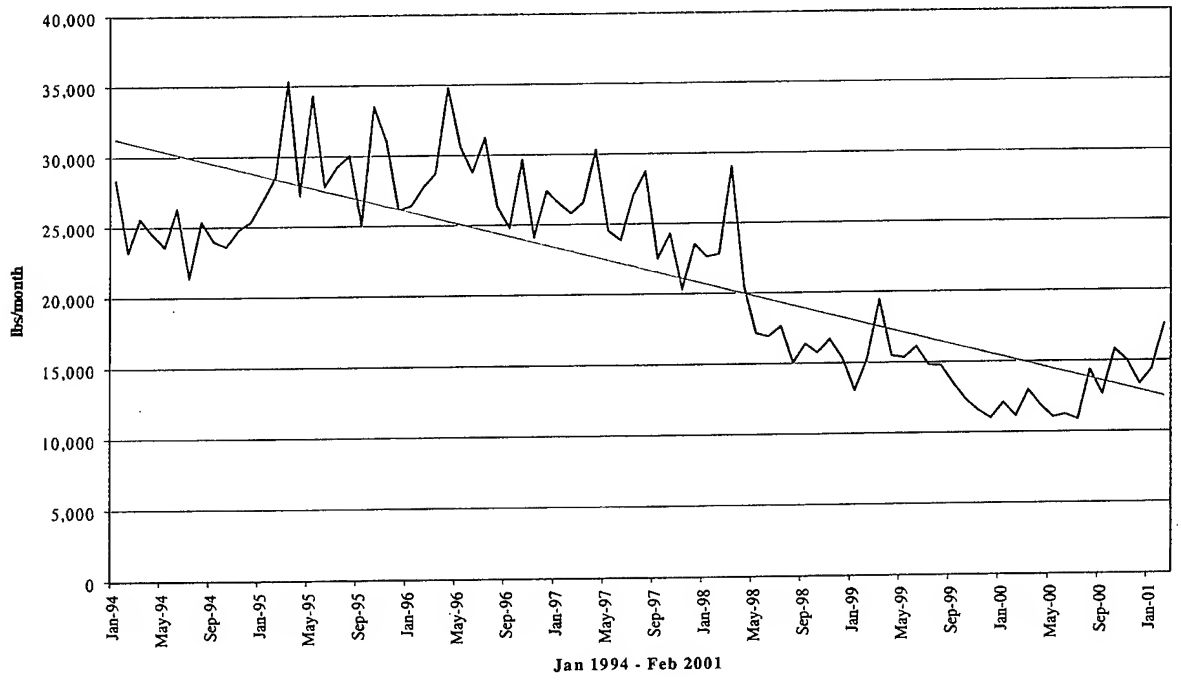

Figure 1. Medical Waste Generated, Jan 1994 – Feb 2001

the incinerator are hydrogen chloride, lead, cadmium, and mercury (see Table 1). Emissions of these pollutants are well below the standards established by the State of Maryland, demonstrating Malcolm Grow's success in keeping toxic materials out of the waste stream.

TABLE 1. PERFORMANCE (STACK) TEST RESULTS

Pollutant	Unit of Measure	Results	Standard	% of Standard
Hydrogen Chloride	ppmvd@7% O_2	12	100	12%
Lead	mg/dscm@7% O_2	0.7	1.2	58%
Cadmium	mg/dscm@7% O_2	0.01	0.16	<1%
Mercury	mg/dscm@7% O_2	0.03	0.55	5%

Of the 69 tons of medical waste generated by Malcolm Grow, the majority (73 percent) comes from operating- and labor and delivery rooms. Approximately 14 percent is laboratory waste, while the remainder (13 percent) is distributed fairly evenly between the Intensive Care Unit, the Emergency Room, and the Surgical Clinics. Figure 2 shows this information graphically. Approximately 30 to 35 boxes of medical waste (660 to 770 lbs) are generated on a "typical" day by the following organizations:

- Second Floor Operating Rooms: ~15 boxes per day (~330 lbs.)
- Third Floor Operating Rooms: ~4 to 5 boxes per day (~88 to 110 lbs.)
- Labor & Delivery Rooms: ~3 to 4 boxes per day (~66 to 88 lbs.)
- Laboratories: ~2 to 3 boxes per day (~44 to 66 lbs.)
- Basement Laboratory: ~ 2 boxes per day (~44 lbs.)
- Intensive Care Unit: ~1 to 2 boxes per day (~22 to 44 lbs.)
- Emergency Room: ~1 to 2 boxes per day (~22 to 44 lbs.)
- 2H Surgical Clinic: ~1 boxes per day (~22 lbs.)
- 2A Surgical Clinic: ~1 boxes per day (~22 lbs.)

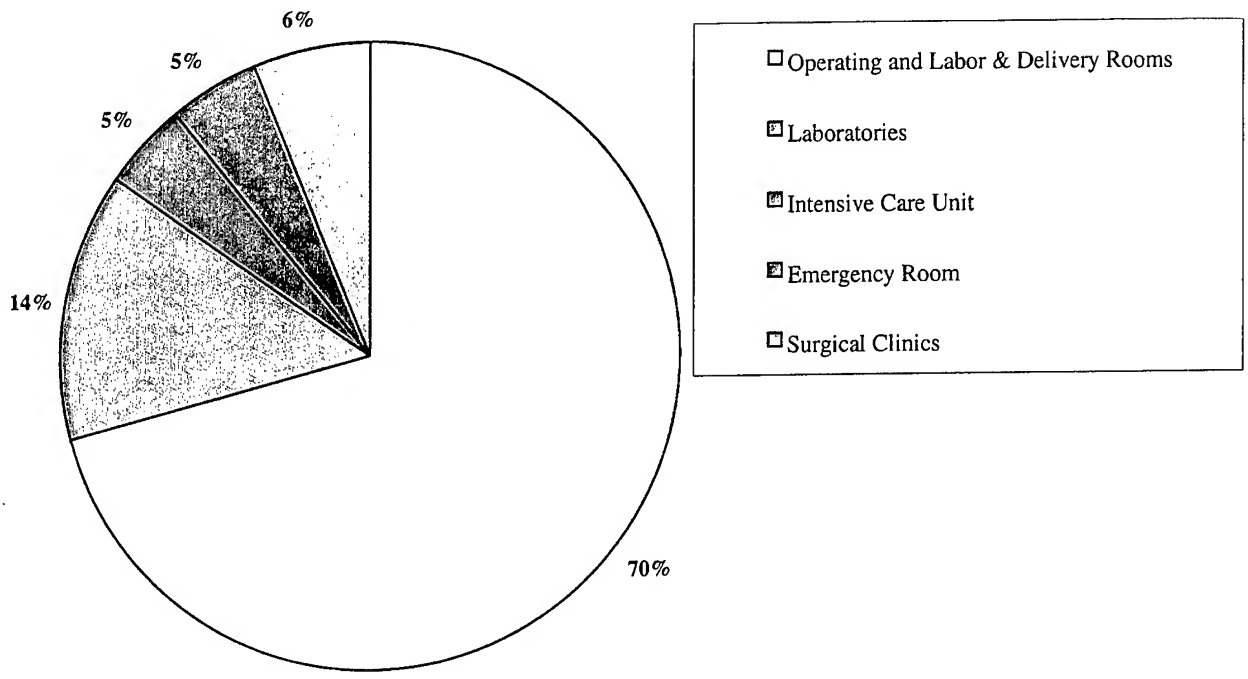

Figure 2. Sources of Medical Waste at Malcolm Grow Medical Center

There are two methods that can be used by Malcolm Grow Medical Center to further reduce toxic emissions from their medical waste incinerator: (1) further reduce the volume of waste generated; and (2) eliminate or reduce certain toxic components in the waste stream that contribute toxic emissions. Malcolm Grow staff have worked hard to reduce the volume of waste generated. As shown in Figure 1, over the past 7 years, the volume of medical waste burned at Malcolm Grow has been reduced considerably. Following, are examples of how this has been accomplished.

During the preparation for surgery, any waste generated, such as Kimguards (disposable blue wraps) and plastic packaging, is discarded as noninfectious waste. Just before the patient enters the operating room, the noninfectious waste bags are sealed, and the medical waste bags ("red bags") are opened. Malcolm Grow has also

reduced the amount of disposable paper products used. Surgical scrubs and jackets that used to be disposed of as medical waste are now laundered and reused.

Malcolm Grow has established an education and empowerment program for its employees, particularly nurses and laboratory technicians, who contribute the vast majority of the medical waste generated. At Malcolm Grow, all newly assigned personnel are briefed on blood-borne pathogens. Each section trains their personnel on the specific types of infectious waste they produce and how to dispose of it. At Malcolm Grow, infectious waste management education is a recurring theme.

The hospital also performs a characterization of medical waste on a regular basis. The types of wastes typically found include soiled or blood-soaked bandages; culture dishes and other glassware; discarded surgical gloves and instruments; syringes, needles, and other "sharps;" cultures, stocks, and swabs used to inoculate cultures; and removed body organs. All of these wastes may be infectious and, therefore, should not be diverted from the medical waste stream. However, nonmedical wastes, such as newspapers, plastic packaging, cardboard, office paper, and magazines should never be disposed of as medical waste. Infection Control, Housekeeping and Facilities Management examine "red bag" waste where it is generated and accumulated. When noninfectious waste is detected, the offending section is given additional training on proper waste disposal procedures.

One method to reduce toxic emissions from the HMIWI is by reducing the amount of metals in the waste stream. As listed in Table 1, the primary metals emitted are lead, cadmium, and mercury, which result from these metals being disposed of in the waste stream.

One way the hospital has reduced emissions of metals is by instituting a program to prevent batteries from being disposed of as medical waste. These batteries include alkaline batteries (common household batteries such as AAA, AA, C, D, and 9-volt),

lithium batteries (used in some cameras), mercuric oxide batteries (also known as "button batteries," used in hearing aids, oxygen monitors, fetal monitors, and portable EKG monitors), nickel-cadmium batteries, and silver-cadmium batteries. At the hospital, batteries are collected at various locations, consolidated, and shipped to a recycler.

The American Hospital Association and the Environmental Protection Agency have spent time and effort to identify sources of mercury at hospitals. However, little information is available in the literature concerning sources of lead and cadmium in medical waste. Sources of mercury from hospitals include medical equipment and mercury-containing products. Most equipment would not be disposed of as medical waste (with the possible exception of mercury thermometers). Mercury-containing products, however, may be. Chemicals and reagents used in hospitals and laboratories that contain mercury include: Thimerosal, Mercury Nitrate, Mercury Iodide, Mercuric Oxide, Mercurochrome, Mercurophyline, Millon's Reagent, Nessler's Solution, Phenol Mercuric Acetate, Takata's Reagent, and stains such as Gram Iodine, Carbol-Fuchin, Mercury Chloride, Carbol Gentian Violet, Gomori's, Cajal's, Golgi's, and Alum Hematoxylin (Solution A). The Facilities Management Section at Malcolm Grow has requested that the Andrews AFB Bioenvironemntal Engineering Flight perform a pollution prevention study to determine mercury-containing products used by the hospital and recommend viable substitutes. Several years ago, it was decided to discontinue the use of mercury thermometers.

Table 1 also lists hydrogen chloride (also known as hydrochloric acid, or HCl) as one of the primary toxic pollutants emitted form the HMIWI. HCl is produced as a result of the combustion of plastic materials, such as polyvinyl chloride, which contains chlorine. Medical products that use polyvinyl chloride include blood bags and tubing, IV containers and components, enema tips, labware, inflatable splints, thermal blankets, thermoformed trays, dialysis tubing, nasogastric tubing, cannulas, inhalation masks, surgical gloves, catheters, drip chambers, and breathing tubes. Reducing the amount of plastic burned by the hospital, however, is not an option. Malcolm Grow has no

control over the types of plastics ordered or used. Surgical packs are centrally procured and used throughout the region.

SUMMARY AND CONCLUSIONS

1. Malcolm Grow Medical Center operates an incinerator equipped with a high energy Venturi wet scrubber that minimizes emissions of criteria and toxic pollutants. Emissions of the toxic pollutants HCl, lead, cadmium, and mercury are in compliance with the standards cited in COMAR 26.11.08.08-1A.

2. Malcolm Grow is proactive in reducing the amount of waste going to the incinerator. All newly assigned personnel are trained on what can and cannot be disposed of as medical waste. The hospital also performs a characterization of the medical waste on a recurring basis. When noninfectious waste is identified with infectious waste, the offending sections are given additional training on proper disposal procedures. The amount of medical waste burned over the past 7 years has been reduced by over 50 percent, reducing toxic emissions proportionally. This reduction surpasses the goal set by EPA and AHA for the year 2010.

3. Malcolm Grow has instituted a battery recycling program at the hospital to keep alkaline- , lithium- , mercuric oxide- , nickel-cadmium- , and silver-cadmium batteries out of the waste stream.

4. Malcolm Grow has requested that the base Bioenvironmental Engineering Flight perform a pollution prevention study to determine mercury-containing products used by the hospital and recommend viable substitutes.